Appl. No. 10/681,497
Response to OA of 12-01-2009

Remarks/Arguments

The Applicant requests the claims following amendment be accepted. Each objection of the 12-01-09 OA is addressed.

General Arguments

The following three general arguments were presented in the Amendment of 10-31-09 and are repeated here for completeness. These general arguments will apply to all of the 12-1-09 OA objections.

General Argument I. Naturally occurring calcium borates (Colemanite and Ulexite) are very poor flame retardants when used in non halogenated plastics (such as polyethylene and EPDM) and/or cellulosic material. Producing an adequate flame resistant composite with either of these compounds requires a 35% or higher loading. One skilled in the art would not consider their use as a fire retardant in the percentages of either Lloyd (4% max) or this present invention (12% max in claim 1or 5% in claim 3).

a. Pitts (USPN 3865760) teaches that Colemanite must be loaded to 150% of the weight of rubber to adequately flame retard that material. Table I (3:40-50) shows that 150 parts of Colemanite in 100 parts of rubber is necessary to establish an Oxygen Index of 29, which is just above the value of 28 required to declare a material non-burning.

Pitts also teaches the flame retardancy characteristics of Colemanite are about the same as those of aluminum trihydrate (3:60-67). As described by Guo et al in *Flame Retarding Effects of Nanoclay on WoodFfiber Composites* (submitted in the attached IDS), loading levels of aluminum trihydrate in wood plastics of more than 60% are required to achieve proper flame retardancy.

b. Kuckro (USPN 6096816) teaches that Colemanite loadings of a minimum of a 2:1 polymer to Colemanite ratio (ie 50% loading) is required to achieve adequate flame retardance (4:33-41 and 4:50-53). Kuckro teaches this ratio for many types of polymers (3:5-11).

c. Panusch (USPN 4076580) teaches that Ulexite and Aluminum Trihydrate are approximately equally effective in flame retardancy of cellulosic composites but a mixture of the two has synergistic properties (3:23-41). However even with this synergistic capability a mixture of the two compounds requires a loading of 35% -50% to achieve flame retardancy in a ¼ inch hardboard (3:60-65). Use of Ulexite alone would require an even higher loading.

General Argument II. Although Zinc Borate when used in a non-halogenated plastic (such as a polyethylene or high density polyethylene) is a relatively inefficient flame retardant, it is five times more effective than Colemanite. One skilled in the art would not be motivated to use Colemanite as a replacement for Zinc Borate in a fire retardant application.

a. O'Brien (USPN 5525757) teaches a minimum zinc borate loading of 7.1% (see Amendment of 1-28 -09) is required to provide adequate fire retardancy which is five times less than the minimum Colemanite loading of 35%.

General Argument III. At the time of the invention most wood plastic composite experts believed there was no need to protect the wood component from decay. For those dissenting experts, a study indicated that at most a 1% loading of Zinc Borate was all that was needed to protect under extreme conditions.

a. Verhey et al in *Laboratory Decay Resistance of Woodfiber/Thermoplastic Composites* (submitted in IDS 1 as part of the original submission on 10-8-03) explain: "The hydrophobic nature of the plastic matrix and its inherent high biodegradation resistance are believed to provide sufficient resistance to fungal degradation without the use of preservative chemicals. If the plastic and wood are mixed in such a ratio that a continuous plastic phase exists in the composite, the wood particles should be encapsulated and protected from the effects of moisture and fungal effect (p1 col 1)".

Verhey then reviewed the existing literature which showed (a) two studies with no decay effects, (b) one study with straw that had low decay, (c) another study that indicated no significant decay in a composite with as much as 70% wood, and finally a study that observed no significant decay at 50% wood loadings and some attack at higher wood loadings (p1 col 3).

Verhey then performs a series of experiments at varying wood and zinc borate loadings and arrives at the conclusion that a 1% loading of Zinc Borate is sufficient to protect the wood from decay (p5 Fig 3 and p5 col 3).

b. The Specification of this present invention identifies that zinc borate of 1.5% was used in lignocellulosic composites. As Verhey identifies, the larger the wood component the more susceptible the composite is to decay. Wood composites are 85% wood – wood plastic composites contain at most 70% wood and the plastic serves as a barrier to decay; therefore Verhey's finding that less preservative (1% vs 1.5%) is consistent.

c. The Example II of the current invention shows that decay is inhibited in a wood plastic composite containing 70% wood, which per Verhey is a worst case wood content, only required a 2% colemanite loading.

Long Felt Need

In previous Amendments the Applicant has identified that providing economical resistance to mold growth in wood plastic composites (WPC's) has been sought by the decking industry for almost two decades. This history is repeated here for completeness:

a. Early 1990's WPC decking is introduced. Initially they are thought to be "maintenance free" (ie. no mold issues) and also immune from decay (IDS 2)

b. 1998: Morris & Cooper publish *Recycled Plastic/Wood Composite Lumber Attacked by Fungi* describing decay and mold attack on WPC's in Florida (IDS 2)

c. May 2000: New Jersey homeowners file suit citing warping, decay, and mold in WPC Decking (IDS 2).

d. May 2004: Superior Court of New Jersey certifies the homeowner's suit at a class action and in July a settlement is reached. One condition is the "maintenance free" term is to be dropped from advertising (IDS 2)

e. 2004 to present: WPC manufacturers continue to seek a solution to this issue (see items f & g).

f. May 2005: Dr. Laks presents study that ZB can provide mold resistance in WPC's at loadings > 2% (IDS 4).

g. Jan 2009: A major WPC deck manufacturer settles a $13 million lawsuit involving mold and mildew on their decks (see IDS 7 submitted with this Amendment –*Class Settlement in AERT Deck Cleaning Lawsuit).*

Arguments regarding OA 3: Claim 16 (and new Claim 21)

RE: Claim 16—Applicant had possession of the invention since (1) the four chemicals [plastic, lignocellulosic material, talc, mica] are specifically described in Example 1 and (2) at section [0011] the additional additives are described as chemicals that could be make up a portion of a lignocellulosic thermoplastic material. The specification identifies the function of these optional additives by name, states that they were well known in the art, and notes that the production of lignocellulosic thermoplastics was performed via well known procedures.

New Claim 21 has been added to document the exact composition of Example 1.

Arguments Regarding OA 5: Claims 1, 3-6, 8-10, 12, and 19

- **Touval (USPN 3926883) in view of Wold (USPN 5,435,954)**

First, Applicant submits arguments presented in the 5-30-2008 (p 6-14) response regarding unexpected results and the additional arguments presented on this page transverse the obviousness rejection. The unexpected results arguments are summarized as follows:

a. No prior art existed in Nov 2002 that described the mold resistance of a boron boron containing fungicide in a lignocellulosic thermoplastic composite.
b. Zinc borate was thought by experts to be ineffective in resisting mold.
c. An EPA report in 1984 stated that zinc borate was ineffective in reducing fungal growth in treated Fabric (IDS #2 of record)
d. Colemanite was shown to be ineffective in resisting mold in plastics [Koskiniemi (USPN 5482989].

e. July 2005 filing on an international patent (WO/2006/0144280) by one of the inventors of USPN6368529 states that the addition of zinc borate to reduce UV degradation of resin composites was surprising.

Applicant then notes that Touval requires stannic oxide in the composite at a very specific ratio of 1:4; if it is not present in this ratio the material is not flame retardant (1:60-67). The present invention has no need of stannic oxide.

Further, one skilled in the art would not be motivated to add stannic oxide to a wood reinforced thermoplastics as it would make the composite unfit for flame retardancy. Reference is made to *Effect of Flame Retardant Treatments on Performance Properties of Wood* by Holms at p89: "Wood that has been effectively treated should not exhibit any after glowing" and then later in the page lists stannic oxide as one of the chemicals reported to stimulate glowing (IDS #5).

Touval also identifies the overall ranges for flame retardants of 0.5 -25 phr is comprised of two components. The first, 0.5 -10 phr, is applicable to polymers containing halogens, such as polyvinyl chloride. The 4-25 phr is for polymers such as polyethylene, which do not contain halogens. The present invention teaches the non-halogen containing polymers.

Specifically, Touval teaches that even when a polyolefin composite is loaded with 8% chlorinated paraffin (a halogen additive – see 9:4-5), 4% stannic oxide (Table 2), and 16% colemanite the composite has an LOI of 20.4 and will still burn (Table 2 and 10:1-4). This is consistent with General Argument I which states a very high loading (35%) of colemanite alone is required for flame retardancy in polyolefins.

The 3 - 5% amounts of colemanite in Touval's Table 1 referenced by the OA are for PVC (7:10) a halogenated thermoplastic and are not valid for the polyolefin thermoplastics of the

present invention. Use of this amount of colemanite in polyolefin material would not achieve flame retardancy and thereby render Touval unfit for purpose.

This information also reveals why the OA argument that one of ordinary skill in this art would have optimized the amount of colemanite to arrive at the claimed range is incorrect. One skilled in the art would be aware that colemanite loadings of 35% or greater would be required to provide flame retardancy in polyolefin materials and would not be experimenting at the much lower range of the present invention.

Arguments Regarding OA 6: Claims 1, 3-5 10, 14, and 19

- Wold (USPN 5,435,954) in view of Borogard ZB

Applicant confirms the date on the Borogard ZB sheet was July 26, 1993.

The label indicates use in wood composites but not wood plastic composites. Per General Argument III, at the time of the invention most wood plastic composite experts believed there was no need to protect the wood component from decay. For those dissenting experts, a study indicated that at most a 1% loading of Zinc Borate was all that was needed to protect WPC's from decay even under extreme conditions.

Therefore one skilled in the art would not have been motivated to incorporate Zinc Borate into WPC's. And this is consistent with the timeline outlined in the long felt need section that indicates no one recognized that ZB loadings >2% would provide the required resistance.

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Arguments Regarding OA 7: Claims 1, 3-5, 8-10, 12, and 18-20

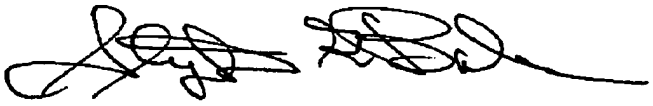
- **Wold (USPN 5,435,954) in view of Lloyd (USPN 4,104,207)**

The OA argues that it would have been obvious to one of ordinary skill to incorporate the method of Lloyd into that of Wold. However for over a decade the WPC decking industry has searched to provide mold resistance in lignocellulosic polyolefins, but with the exception of the current invention (which was submitted as a non-publication) no has ever incorporated calcium borate to do so.

Calcium borate has never been used in any commercial product as a fungicide since this use would require EPA Registration and the chemical is not so registered. And an attempt to use calcium borate as a flame retardant in lignocellulosic PE or HDPE would have required a loading of 35% (General Argument II) which is much larger than 12% maximum of the present invention. Further a loading of 35% colemanite combined with a 25% polyolefin content would leave a wood content of only 40% and most decking WPC's have wood content of > 40%.

For all the above reasons, as well as those presented in the previous amendments, Applicant respectfully submits the distinctions are of patentable merit. Accordingly Applicant submits this applications is now in full condition for allowance.

Respectfully submitted,



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